

# Principles of Knowledge Representation and Reasoning

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## Exercise Sheet 8

**Due: June 24, 2008**

**Exercise 8.1** (Cumulative and Preferential Consequences, 4 marks)

For each of the parts of this exercise, provide a (different!) example of a set of plausible consequences  $\mathbf{K}$  and a plausible consequence  $\varphi \sim \psi$  with the given property, and prove that your answer is correct (by giving derivations and/or counterexamples as appropriate). If the property does not hold for any set  $\mathbf{K}$  and formulae  $\varphi$  and  $\psi$ , prove this.

- (a)  $\mathbf{K}$  implies  $\varphi \sim \psi$  in system  $\mathbf{C}$  and in system  $\mathbf{P}$ .
- (b)  $\mathbf{K}$  implies  $\varphi \sim \psi$  in system  $\mathbf{C}$ , but not in system  $\mathbf{P}$ .
- (c)  $\mathbf{K}$  implies  $\varphi \sim \psi$  in system  $\mathbf{P}$ , but not in system  $\mathbf{C}$ .
- (d)  $\mathbf{K}$  does not imply  $\varphi \sim \psi$  in either system  $\mathbf{C}$  or system  $\mathbf{P}$ .

**Exercise 8.2** ( $\epsilon$ -Entailment, 6 marks)

Which of the following proof rules are correct for  $\epsilon$ -entailment? Give a proof using the definition of  $\epsilon$ -entailment or a counterexample. (Do not use the theorem that links  $\epsilon$ -entailment to preferential reasoning – the point of this exercise is to provide part of the proof for that theorem.)

- (a) Or: 
$$\frac{\alpha \sim \gamma, \beta \sim \gamma}{\alpha \vee \beta \sim \gamma}$$
- (b) Monotonicity: 
$$\frac{\models \alpha \rightarrow \beta, \beta \sim \gamma}{\alpha \sim \gamma}$$
- (c) Cautious Monotonicity: 
$$\frac{\alpha \sim \beta, \alpha \sim \gamma}{\alpha \wedge \beta \sim \gamma}$$